

STARVE HOLLOW LAKE
Jackson County
2006 Fish Management Report

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EXECUTIVE SUMMARY

- Starve Hollow Lake is a 145-acre impoundment owned by the Indiana Department of Natural Resources (IDNR), Division of Forestry. It is located in Jackson County about 7 mi south of Brownstown in southeastern Indiana. Access includes three boat ramps; only electric motors are allowed. Maps of the property are available from Starve Hollow State Recreation Area, 4345 South County Road 275 West, Vallonia, Indiana 47281.
- A survey of largemouth bass, bluegill, and gizzard shad was conducted on Starve Hollow Lake on June 5 and 14, 2006, as part of a Division of Fish and Wildlife (DFW) work plan, titled, "Gizzard shad experimental management strategies." The management activity being tested at Starve Hollow is an annual winter drawdown with a goal of a 50% reduction in volume during January and February. Starve Hollow Lake will be surveyed annually in early to mid-June from 2005 through 2009 to evaluate this drawdown strategy.
- A total of 2,375 fish, representing three species, was collected during this survey. By number, bluegill ranked first, followed by gizzard shad and then largemouth bass. By weight, gizzard shad ranked first, followed by largemouth bass and then bluegill.
- Bluegill PSD is far below the range of 20 to 60 that represents a balanced population. Bluegill reached 6.0 in TL at the end of their 4th year of growth, which is average for southeastern Indiana.
- Largemouth bass represented a balanced population; the PSD is near the upper limit of the desired range (40 to 70) for a balanced bass fishery. Largemouth reached 14.0 in TL at the end of their 5th year of growth, which is above average for southeastern Indiana.
- The electrofishing catch rate for gizzard shad was 644.7/h, an increase from 520.7/h in 2005. The catch rate has more than doubled since 2004.
- In Starve Hollow Lake, the DFW should maintain a 14.0-in minimum size limit on largemouth bass, continue to stock 2,320 (16/acre) channel catfish every two years, and continue to monitor submersed vegetation.

FIGURES

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INTRODUCTION

Starve Hollow Lake is a 145-acre impoundment owned by the Indiana Department of Natural Resources (IDNR), Division of Forestry. It is located in Jackson County about 7 mi south of Brownstown in southeastern Indiana. Construction was completed in 1938. Access includes three boat ramps; only electric motors are allowed. Maps of the property are available from Starve Hollow State Recreation Area, 4345 South County Road 275 West, Vallonia, Indiana 47281.

Starve Hollow Lake has a 14.0-in minimum size limit on largemouth bass. Prior fish management activities include a fishery renovation in 1987 and restocking of 14,572 largemouth bass, 35,650 bluegill, 36,250 redear sunfish, 1,819 black crappie, and 3,700 channel catfish. Starve Hollow Lake is currently stocked with 2,320 (16/acre) channel catfish every other year.

Starve Hollow Lake is scheduled to be surveyed from 2005 through 2009 under a Division of Fish and Wildlife (DFW) work plan, which is titled, "Gizzard shad experimental management strategies." The work plan objectives are:

1. Report on how the illegal introductions of gizzard shad have negatively affected sport fish populations and reduced fishing opportunities.
2. Determine the most effective way(s) to control excessive gizzard shad populations.
3. Determine how sport fish populations respond to various gizzard shad management techniques.

Starve Hollow will be surveyed from early to mid-June each year. Only largemouth bass, bluegill, and gizzard shad will be collected. The management activity being tested at Starve Hollow is an annual winter drawdown with a goal of a 50% reduction in volume during January and February. The lake was drawn down in 2005 and 2006.

METHODS

A survey of largemouth bass, bluegill, and gizzard shad was conducted June 5 and 14, 2006. A GPS unit, GARMIN GPSmap 76, was used to record the location of the fish collection sites.

Fish were collected by pulsed DC electrofishing along the shoreline on two nights with two dippers for 1.5 h. The lake's shoreline was divided into six 15-min electrofishing stations.

The odd-numbered stations were sampled the first night and the even-numbered stations were sampled the second night.

All largemouth bass collected and subsamples of bluegill and gizzard shad were measured to the nearest 0.1 in TL. The remaining bluegill and shad were counted but not measured. The length-frequency distributions of 1,311 bluegill and of 967 gizzard shad were created based on the proportion by number of each half-inch group of the subsample of 274 bluegill and of 156 shad.

Fish were not weighed; average weights for fish by half-inch groups for Fish Management District 8 were used to estimate the weight of the fish sample. Fish scale samples were taken from largemouth bass, bluegill, and gizzard shad for age and growth analysis. The proportional stock density (PSD) was calculated for largemouth bass and bluegill (Anderson and Neumann 1996). The bluegill PSD was calculated using only the bluegill subsample. The Bluegill Fishing Potential (BGFP) index was used to assess bluegill fishing quality (Ball and Tousignant 1996).

RESULTS

A total of 2,375 fish, representing three species, was collected during this survey. Total weight of the fish sample was approximately 400 lbs. By number, bluegill ranked first, followed by gizzard shad and then largemouth bass. By weight, gizzard shad ranked first, followed by largemouth bass and then bluegill.

A total of 1,311 bluegill was sampled that weighed 63 lbs. They ranged in length from 1.5 to 7.4 in TL, averaging 4.0 in TL. Relative abundance was 55% by number and 16% by weight. The electrofishing catch rate was 874.0/h, an increase from 699.3/h in 2005 (Kowalik and Lehman 2006). Bluegill did not represent a balanced population; the bluegill PSD was 2, which is a decrease from 13 in 2005. In the subsample, only 2% of the bluegill were 6.0 in or longer (i.e. quality size), a decrease from 7% in 2005. The BGFP index was 11, which is in the marginal category, compared to 17 in 2005. Growth was similar to 2005 and back-calculated lengths indicate bluegill reached 6.0 in at the end of their 4th year of growth, which is average for southeastern Indiana (Figure 1).

A total of 967 gizzard shad was sampled that weighed 195 lbs. They ranged in length from 5.8 to 12.3 in TL, averaging 8.2 in TL. Relative abundance was 41% by number and 49%

by weight. The electrofishing catch rate was 644.7/h, an increase from 520.7/h in 2005 and 300.0 in 2004 (Kowalik and Lehman 2006) in spite of winter drawdowns in 2005 and 2006. Gizzard shad were not aged.

A total of 97 largemouth bass was sampled that weighed 142 lbs. They ranged in length from 4.3 to 21.8 in TL, averaging 12.8 in TL. Relative abundance was 4% by number and 35% by weight. The electrofishing catch rate was 64.7/h, decreasing from 108.0/h in 2005 (Kowalik and Lehman 2006). Largemouth represented a balanced population; the largemouth PSD was 66, which is similar to 2005. Back-calculated lengths indicate largemouth bass reached 14.0 in at end of their 5th year of growth, which is above average for southeastern Indiana (Figure 2).

DISCUSSION

The largemouth bass catch rate has declined from 2005; however, a greater percentage of legal bass were collected in 2006 than in 2005. The PSD in 2006 and 2005 is near the upper limit (70) of the desired range for a balanced bass fishery, which means that the number of 8.0 to 11.9-in bass may become too low compared to the number of bass 12.0 in and longer. After the 2005 survey, we suggested that shad may be growing too quickly and too large to be susceptible to predation by bass for more than 1 or 2 years. According to the 2006 survey, bass growth has increased since 2005 at all ages and growth is above the district average, which is probably explained by the abundance of prey (i.e. gizzard shad and bluegill have increased in number from 2005). Dense and abundant submersed vegetation may inhibit bass from foraging on the small bluegill, however, which would have a negative effect on the bluegill population.

The 2004 report stated that the bluegill fishery appeared to be declining, which may be correlated with the appearance and establishment of gizzard shad. The bluegill catch rates of 2004 and 2005 were similar, but the bluegill catch rate increased greatly in 2006. The PSD, however, greatly decreased to well below the desired range for a balanced fishery. In the subsample, 91% of the bluegill were 3.0 to 5.9-in bluegill while only 2% were quality size. The PSD decline played a major role in the BGFP index decreasing from fair to marginal. Bluegill over 8.0 in were still absent from the collection.

An increase in the relative abundance by number and by weight and an increase in the electrofishing catch rate indicate that gizzard shad are more abundant now than in 2004 and 2005 in spite of two winter drawdowns in which many shad died from stress. We suggested that by

the end of their second year, many shad are too big to be utilized by predators in the lake except for large, older bass.

Gizzard shad have contaminated the ponds at Driftwood State Fish Hatchery, which presents several problems for hatchery personnel and Indiana anglers: 1) competition from shad interferes with game fish production; 2) extra work is required during pond harvest to ensure that all gizzard shad are removed from those fish raised for stocking in Indiana's public waters; and 3) there is a risk of accidentally stocking shad into Indiana waters where they are not desired.

Starve Hollow Lake should be drained and renovated to correct the gizzard shad problem in the lake and the problems associated with shad contamination of Driftwood's production ponds under the following circumstances: 1) if and when the lake is dredged by the Division of Forestry to address the loss of volume due to sedimentation; 2) if and when the lake is drained by the Division of Forestry to repair the dam; and 3) if and when the public wants to renovate the fishery in the lake without dredging it. Largemouth bass, bluegill, redear sunfish, black crappie, and channel catfish would be restocked by the DFW following the fisheries renovation.

RECOMMENDATIONS

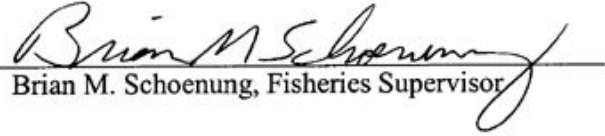
- Starve Hollow Lake should be drained and renovated to eradicate gizzard shad.
- If not drained and renovated, Starve Hollow should continue to undergo an annual winter drawdown with a goal of a 50% reduction in volume during January and February.
- The DFW should maintain the 14.0-in minimum size limit on largemouth bass at Starve Hollow Lake.
- The DFW should continue to stock 2,320 channel catfish every two years. These channel catfish should average at least 8 in long to reduce mortality from bass predation.
- Submersed vegetation should continue to be monitored and controlled to manage the bass and bluegill fishery and to provide angler access.

LITERATURE CITED

- Anderson, R. O. and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-481 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.
- Ball, R. L. and J. N. Tousignant. 1996. The development of an objective rating system to assess bluegill fishing in lakes and ponds. Research report. Indiana Department of Natural Resources. Indianapolis, Indiana. 18 pp.
- Kowalik, C. R. and L. L. Lehman. 2006. Starve Hollow Lake Fish Management Report, 2005. Fisheries Section, Indiana Department of Natural Resources, Indianapolis. 13 pp.

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Brian M. Schoenung, Fisheries Supervisor

Date: January 31, 2008

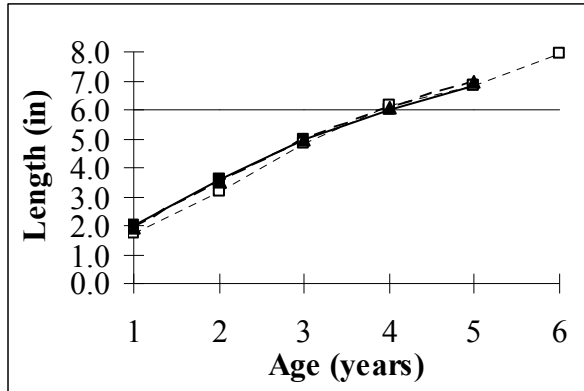


Figure 1. Starve Hollow Lake bluegill growth from 2006 survey (solid line) compared to 2005 survey (dashed line) and to average bluegill growth observed in Fish Management District 8 impoundments (dotted line).

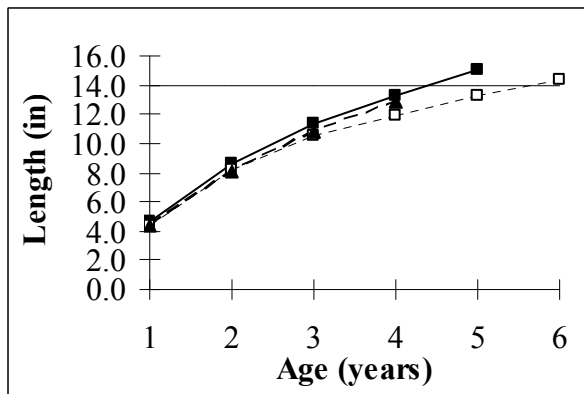


Figure 2. Starve Hollow Lake largemouth bass growth from 2006 survey (solid line) compared to 2005 survey (dashed line) and to average largemouth bass growth observed in Fish Management District 8 impoundments (dotted line).

LAKE SURVEY REPORT

Type of Survey
<input type="checkbox"/> Initial Survey <input checked="" type="checkbox"/> Re-Survey

Lake Name Starve Hollow Lake	County Jackson	Date of survey (Month, day, year) June 5 and 14, 2006
Biologist's name Larry L. Lehman		Date of Approval (Month, day, year) January 31, 2008

LOCATION		
Quadrangle Name Vallonia, IND. 1959. Photorevised 1980	Range 4E	Sections 3 and 4
Township 4N	Nearest Town Vallonia	

ACCESSIBILITY					
State owned public access site Three concrete boat ramps		Privately owned public access site None present		Other access site Shoreline fishing on dam	
Surface acres 145	Maximum depth approx. 18 feet	Average depth 6.7 feet	Volume (acre feet) 972	Water level (Feet MSL) 548	Extreme fluctuations 546.5 - 548.5 feet MSL
Location of benchmark Approximately 0.5 mile northwest of lake					

INLETS		
Name Mill Creek	Location North end of lake	Origin Farmland, forest
Unnamed	East bay of lake	Forest
Unnamed (2)	Northwest bay	Farmland, forest

OUTLETS			
Name Mill Creek		Location South side of lake at principal spillway	
Water level control Concrete principal spillway in earthen dam. A large drawdown tube is located in the spillway.			
POOL	ELEVATION (Feet MSL)	ACRES	Bottom type <input type="checkbox"/> Boulder <input type="checkbox"/> Gravel <input checked="" type="checkbox"/> Sand <input type="checkbox"/> Muck <input checked="" type="checkbox"/> Clay <input type="checkbox"/> Marl
TOP OF DAM			
TOP OF EMERGENCY SPILLWAY			
NORMAL POOL	548.0	145	
TOP OF MINIMUM POOL			
STREAMBED			

Watershed use: Watershed covers approximately 4,272 acres. Approximately 75% of the watershed is covered with hardwood forest. Most of the remainder (~22%) is agriculture and grass/pasture. (source is <http://pasture.ecn.purdue.edu>)

Development of shoreline
The Department of Natural Resources has provided a beach, bathhouse, 3 boat ramps, fishing piers including several handicap accessible piers, a boat dock with rental rowboats and canoes, mooring posts, camping, and picnic sites. Several private homes are located on the western shore.

Previous surveys and investigations
Hydrographic survey 1959. Renovated 1961. Population study 1963. Northern pike study 1966. Creel surveys 1963, 1964, 1974, 1975, 1978, 1979, 1980, 1986. Fishery surveys 1961, 1970, 1973, 1975, 1978, 1982. Renovated 1987.

Spot-check surveys 1988, 1998. Channel catfish study 1989-1990. Bluegill quality study and largemouth estimate 1990.

Creel survey 1990. Fishery surveys 1994, 1996, 1999. Gizzard shad study 2004, 2005.

SAMPLING EFFORT					
ELECTROFISHING	Day hours 0		Night hours 1.5**		Total hours 1.5**
TRAP NETS	Number of traps 0		Number of Lifts 0		Total effort 0
GILL NETS	Number of nets 0		Number of Lifts 0		Total effort 0
ROTENONE	Gallons 0	ppm	Acre Feet Treated	SHORELINE SEINING	Number of 100 Foot Seine Hauls none

PHYSICAL AND CHEMICAL CHARACTERISTICS					
Color			Turbidity		
			Feet		Inches (SECCHI DISK)
Alkalinity (ppm)*			pH		
			Surface:		Bottom:
Conductivity: 6/5/06 225 micromhos/cm			Air temperature:		
Conductivity: 6/14/06 210 micromhos/cm			°F		
Water chemistry GPS coordinates:					
N			W		

TEMPERATURE AND DISSOLVED OXYGEN (D.O.)								
DEPTH (FEET)	Degrees (°F)	D.O. (ppm)	DEPTH (FEET)	DEGREES (°F)	D.O. (ppm)	DEPTH (FEET)	DEGREES (°F)	D.O. (ppm)
SURFACE	***		36			72		
2			38			74		
4			40			76		
6			42			78		
8			44			80		
10			46			82		
12			48			84		
14			50			86		
16			52			88		
18			54			90		
20			56			92		
22			58			94		
24			60			96		
26			62			98		
28			64			100		
30			66					
32			68					
34			70					

COMMENTS	
**Electrofisher settings (6/5/06 and 6/14/06): 530 volts DC, output mode = 60 pps, and pulse width = 3 ms (~5 amps)	
***Surface temperature (6/5/06 and 6/14/06): 79°F	
Starve Hollow Lake was at normal pool.	

*ppm-parts per million

SPECIES AND RELATIVE ABUNDANCE OF FISHES COLLECTED BY NUMBER AND WEIGHT					
*COMMON NAME OF FISH	NUMBER	PERCENT	LENGTH RANGE (inches)	WEIGHT (pounds)	PERCENT
Bluegill	1,311	55.2	1.5-7.4	63.20	15.8
Gizzard shad	967	40.7	5.8-12.3	194.76	48.7
Largemouth bass	97	4.1	4.3-21.8	141.56	35.4
Totals (3 species)	2,375	100.0		399.52	100.0

*Common names of fishes recognized by the American Fisheries Society.

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF: Bluegill Starve Hollow Lake 6/5/06 and 6/14/06									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5	5	0.4	< 0.01	1	19.5				
2.0	14	1.1	< 0.01	1	20.0				
2.5	24	1.8	0.01	1	20.5				
3.0	196	15.0	0.02	1	21.0				
3.5	153	11.7	0.03	2	21.5				
4.0	454	34.6	0.04	2	22.0				
4.5	316	24.1	0.06	2, 3	22.5				
5.0	67	5.1	0.08	2, 3	23.0				
5.5	48	3.7	0.11	3	23.5				
6.0	19	1.4	0.15	3, 4	24.0				
6.5	5	0.4	0.19	4	24.5				
7.0	5	0.4	0.24	5	25.0				
7.5	5	0.4	0.30	5	25.5				
8.0					26.0				
8.5					TOTAL	1,311			
9.0									
9.5					Subsample: PSD = 6/254(100) = 2.4				
10.0									
10.5					Subsample: % \geq 6.0 inches = 6/274(100) = 2.2				
11.0									
11.5					Bluegill Fishing Potential Index = 11 (marginal)				
12.0									
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									
ELECTROFISHING CATCH		874.0/hr		GILL NET CATCH	N/A		TRAP NET CATCH		N/A

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF: Gizzard shad Starve Hollow Lake 6/5/06 and 6/14/06									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5					21.5				
4.0					22.0				
4.5					22.5				
5.0					23.0				
5.5					23.5				
6.0	37	3.8	0.07	Not aged	24.0				
6.5	12	1.2	0.09		24.5				
7.0	186	19.2	0.12		25.0				
7.5	180	18.6	0.14		25.5				
8.0	167	17.3	0.17		26.0				
8.5	105	10.9	0.20		TOTAL	967			
9.0	50	5.2	0.25						
9.5	112	11.6	0.28						
10.0	32	3.3	0.34						
10.5	37	3.8	0.40						
11.0	37	3.8	0.46						
11.5									
12.0	6	0.6	0.60						
12.5	6	0.6	0.67						
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									
ELECTROFISHING CATCH		644.7/hr		GILL NET CATCH	N/A		TRAP NET CATCH		N/A

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF: Largemouth bass, Starve Hollow Lake, 6/5/06 and 6/14/06									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0	4	4.1	3.72	—
1.5					19.5				
2.0					20.0	2	2.1	4.13	—
2.5					20.5	1	1.0	5.00	—
3.0					21.0				
3.5					21.5				
4.0					22.0	1	1.0	5.60	—
4.5	5	5.2	0.04	1	22.5				
5.0					23.0				
5.5	4	4.1	0.07	1	23.5				
6.0	1	1.0	0.10	1	24.0				
6.5	1	1.0	0.12	1	24.5				
7.0	1	1.0	0.16	1	25.0				
7.5					25.5				
8.0	1	1.0	0.24	1	26.0				
8.5	2	2.1	0.28	2	TOTAL	97			
9.0	6	6.2	0.34	2					
9.5	4	4.1	0.41	2		PSD = $55/84(100) = 65.5$			
10.0	4	4.1	0.48	2					
10.5	6	6.2	0.57	2		% \geq 14.0 inches = $42/97(100) = 43.3$			
11.0	1	1.0	0.64	2					
11.5	6	6.2	0.74	2, 3					
12.0	3	3.1	0.84	3					
12.5	1	1.0	0.97	3					
13.0	3	3.1	1.09	3, 4					
13.5	5	5.2	1.24	3, 4					
14.0	6	6.2	1.39	3, 4					
14.5	5	5.2	1.59	3, 4					
15.0	3	3.1	1.72	4, 5					
15.5	4	4.1	1.93	4, 5					
16.0	1	1.0	2.06	5					
16.5	3	3.1	2.53	—					
17.0	3	3.1	2.40	5					
17.5	4	4.1	3.02	—					
18.0	3	3.1	3.46	—					
18.5	3	3.1	3.54	—					
ELECTROFISHING CATCH		64.7/hr		GILL NET CATCH	N/A		TRAP NET CATCH		N/A

Species Bluegill	YEAR CLASS	Number of fish aged	SIZE RANGE	BACK CALCULATED LENGTH (inches) AT EACH AGE							
				1	2	3	4	5	6	7	8
Intercept= 0.8"	2005	14	1.5-3.2	2.1							
	2004	17	3.3-5.0	2.1	3.7						
	2003	12	4.5-6.1	2.1	3.9	5.1					
	2002	7	6.2-6.7	1.8	3.5	5.1	6.1				
	2001	5	6.8-7.4	1.7	3.3	4.9	5.9	6.8			
	AVERAGE LENGTH			2.0	3.6	5.0	6.0	6.8			
	NUMBER AGED			55	41	24	12	5			

Species Largemouth bass	YEAR CLASS	Number of fish aged	SIZE RANGE	BACK CALCULATED LENGTH (inches) AT EACH AGE							
				1	2	3	4	5	6	7	8
Intercept= 0.8"	2005	12	4.3-7.9	4.7							
	2004	24	8.6-11.7	4.2	9.3						
	2003	16	11.3-14.6	4.9	9.2	12.4					
	2002	8	13.0-15.7	4.8	7.9	10.8	13.6				
	2001	7	15.1-16.8	4.3	8.1	10.6	13.1	15.0			
	AVERAGE LENGTH			4.6	8.6	11.3	13.3	15.0			
	NUMBER AGED			67	55	31	15	7			

*Not included in average length calculations.

GPS LOCATION OF SAMPLING EQUIPMENT Starve Hollow Lake on 6/5/06 and 6/14/06								
GILL NETS			TRAP NETS			ELECTROFISHING		
1	N	W	1	N	W	1	N 38.81078	W -86.08248
	N	W	2	N	W		N 38.80954	W -86.08019
2	N	W	3	N	W	2	N 38.80918	W -86.07606
	N	W	4	N	W		N 38.81285	W -86.07546
3	N	W	5	N	W	3	N 38.81353	W -86.07532
	N	W	6	N	W		N 38.81624	W -86.07287
4	N	W	7	N	W	4	N 38.81775	W -86.07362
	N	W	8	N	W		N 38.81478	W -86.07656
5	N	W	9	N	W	5	N 38.81475	W -86.07668
	N	W	10	N	W		N 38.81398	W -86.08235
6	N	W	11	N	W	6	N 38.81506	W -86.08342
	N	W	12	N	W		N 38.81149	W -86.08226
7	N	W	13	N	W	7	N	W
	N	W	14	N	W		N	W
8	N	W	15	N	W	8	N	W
	N	W	16	N	W		N	W
9	N	W	17	N	W	9	N	W
	N	W	18	N	W		N	W
10	N	W	19	N	W	10	N	W
	N	W	20	N	W		N	W
11	N	W				11	N	W
	N	W					N	W
12	N	W				12	N	W
	N	W					N	W
13	N	W				13	N	W
	N	W					N	W
14	N	W				14	N	W
	N	W					N	W
15	N	W				15	N	W
	N	W					N	W
16	N	W				16	N	W
	N	W					N	W
17	N	W				17	N	W
	N	W					N	W
18	N	W				18	N	W
	N	W					N	W
19	N	W				19	N	W
	N	W					N	W
20	N	W				20	N	W
	N	W					N	W